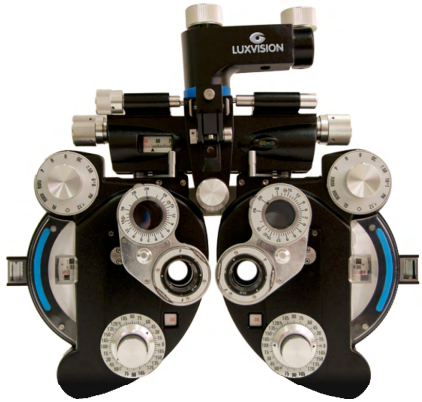
R-2600 MANUAL REFRACTOR

User's Manual



LUXVISION

Instruction

Thanks for purchasing and using vision tester.

Before using our instrument,please read this manual carefully.We sincerely hope that it will provide you with enough information.

Providing products with more refined quality, complete function and characteristics to customers is our target. We regret any inconvenience caused by not notifying you the differences of products from those advertised on promotional and packaging materials resulted by product performance enhancement. Meanwhile we reserve the right of constantly updating products and materials.

If there is any problem during use, please contact authorized distributor.

Your satisfaction is the cornerstone of our progress!

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1. Introduction

1.1 Uses

This instrument is applicable with stand and projection for precision measurement of visual functions such as myopia, hyperopia, astigmatism, visual acuity balance, phoria, stereoscopic vision and visual acuity amalgamation.

1.2 Characteristics

⌂ Unique design of butterfly-shape appearance.

⌂ Capable of checking up all-sided visual functions, accurate and comfortable in measurement.

⌂ Exquisite manufacturing technique, with comfortable feel.

⌂ High quality plated-film used in all optic lenses.

⌂ Technology and design patents

1.3 Working Environment

The instrument should be installed and worked under such environment:

⌂Temperature: 5°C- 40°C

⌂ Humidity: below 85%RH (No condensation)

⌂ Environmental pressure: 800-1060hPa

⌂Clean indoor place

⌂No direct strong light

⌂ No vibration and collision

1.5 Main technical indexes

1.5.1 Spherical Lens	Range of measurement: -19.00D ~ +16.75D Step length: 0.25D (being 0.12D when 0.12D auxiliary lens is used)
1.5.2 Cylindrical Lens	Range of measurement: 0 ~ - 6.00D (being 0 ~ - 8.00D when additional lens is used) Step: 0.25D (being 0.12D when additional lens is used)
1.5.3 Axis of Cylindrical Lens	Range of measurement: 0~180° Step: 5°
1.5.4 Cross Cylindrical Lens	±0.25D
1.5.5 Rotary Prism	Range of measurement: 0~20 Δ Step: 1 Δ
1.5.6 Prism basal angle	Range of measurement: 0~180° Step: 5°
1.5.7 Pupil Distance	Range: 50mm~70mm Step: 1mm
1.5.8 Aggregated Adjustment	∞, 380mm (when PD=64mm)
1.5.9 Adjustment of Forehead Rest	16mm
1.5.10 Vertex Distance	13.75mm
1.5.11 Overall Dimensions	335mm(L)×320mm(W)×90mm(H)
1.5.12 Weight	4.5 kg (instrument only)

1.6 Name plate and indications

Name plate and indications are sticked on the instrument to arise end-users' notice.

In case the name plate is not sticked well or the characters become unclear to recognize, please contact authorized distributors.

1.7 Safety Notice

⌂When taking the vision tester, one should hold mounting

Fig.1

Fig.2

handle (Fig.1) at upper part of the instrument or carry left and right ends of the instrument by both hands (Fig.2).

⌂ Do not set the instrument with face down or exert pressure onto surface of lens, and do not toucb lens by band.

⌂The instrument shall not be put in a damp and dusty room.

⌂All moving parts can be turned in dual-direction. However, care must be taken to do it, and do not turn it beyond the limit position so as to avoid damage to the device.

⌂ The plastic part (Forehead Rest and spirit level , etc.) that

can be scrubbed shall be swabbed down using cotton cloth, and do not use cleaning liquid or other chemicals.

⌂ Vision tester belongs to precision instrument, so do not dismantle it at random.

2.Configuration

2.1 Parts

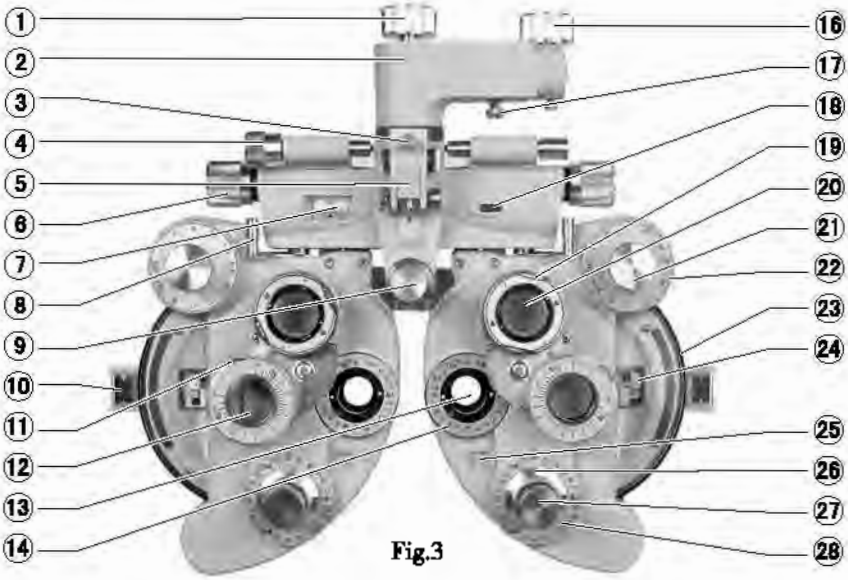


Fig.3

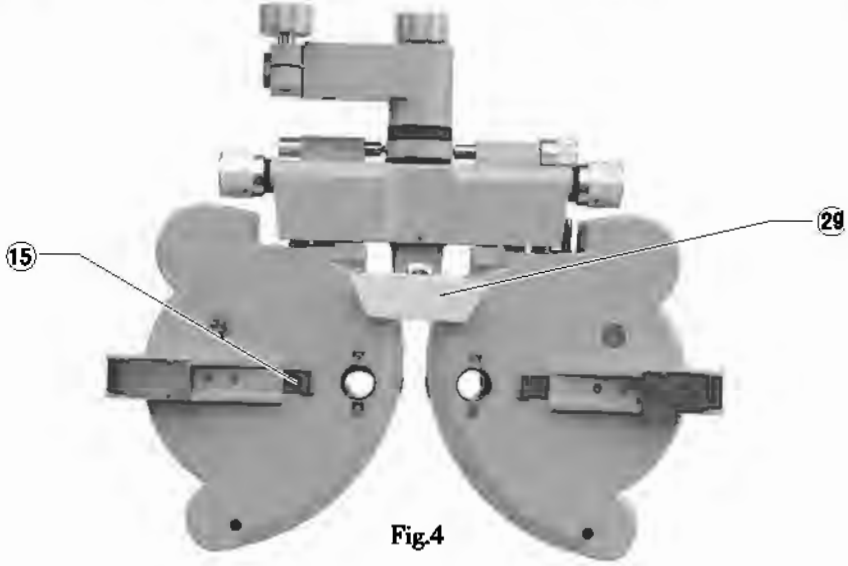


Fig.4

① Rotation Adjustment Knob

Used to adjust direction of instrument's main body

② Mounting Handle

Used to install the instrument onto eye-optometry table

③ Clamping Screw

Used to fix near-point rod

④ Leveling Adjusting Knob

Used to adjust level position of the instrument

⑤ Near Point Rod Holder

Used to attach near-point testing mark rod to hanger frame

⑥ Pupil Distance Knob

Used to adjust pupil distance

⑦ Pupil Distance Scale

Used to display pupil distance

⑧ Vergence Lever

Used to adjust corner of device's left and right disks

⑨ Forehead Rest Knob

Used to adjust patient's forehead position

⑩ Corneal Aligning Aperture

Used to display position of patient's cornea vertex

⑪ Prism Rotation Knob

Used to adjust prism power

⑫ Rotary Prism

Used to test phoria or binocular balance

⑬ Examination Aperture

Aperture for test, with various lenses set here

⑭ Cylindrical Lens Axis Scale

Used to indicate cylindrical lens axis angle

⑮ Face shield Clip

Fix face shield

⑯ Fixing Hand-wheel

Used to fix instrument to ophthalmic stand

⑰ Tightening Screw

Used to fix instrument to ophthalmic stand, and stored in accessory box

⑱ Spirit Level

Used to indicate level direction

⑲ Rotation Knob

Used to adjust astigmatic axis of cross cylindrical lens

⑳ Cross Cylindrical Lens

Used to precisely check astigmatic power and axis

㉑ Auxiliary Lens Knob

Used for various visual acuity tests

㉒ Strong Spherical Power Knob

Used to adjust big spherical lens power, step: 3.00D

㉓ Weak Spherical Power Dial

Used to adjust small spherical lens power, step: 0.25D

㉔ Spherical Power Scale

Used to display spherical lens power

㉕ Cylindrical Power Scale

Used to display cylindrical lens power

㉖ Cylindrical Lens Axis Knob

Used to adjust cylindrical lens axis

㉗ Cylindrical Lens Knob

Used to set cylindrical lens to examination aperture

㉘ Cylindrical Lens Axis Scale

Used to display angle of cylindrical lens axis

㉙ Forehead Rest

Patient's forehead rests here

㉚ Instruction Manual

㉛ Near Point Rod

Card holder is attached on this rod

㉜ Near Point Card

Including near point sight mark

㉝ Card Holder

Used to attach near point card

㉞ Dust Cover

Use dust cover to protect instrument from dust

㉟ Accessories Box

Used to store the standard accessories

㊱ Face shield

Left and right face shields, one each, are installed on position where instrument and patient's nose contact

㊲ Balloon with Brush

Used to clean lens

㊳ Additional Lens

Used to change testing range and precision

Fig.5

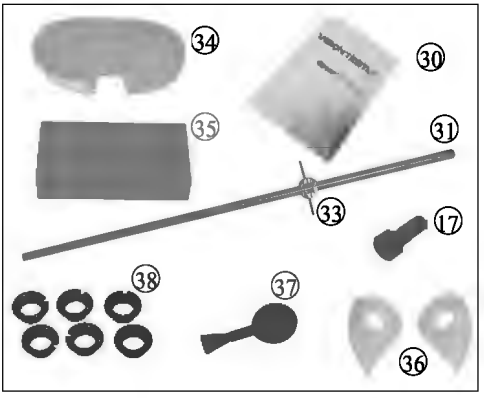


Fig.6

3.Assembly

3.1 Attaching Instrument to Ophthalmic Stand

a.When assembly is conducted, first insert the mounting rod extending from the ophthalmic stand to hole of mounting handle ②, and fix it with fixing hand-wheel ⑯. Then tighten tightening screw ⑰ under mounting handle ②. Tightening screw ⑰ is stored in standard accessories box ㉟.

b.Turn leveling adjusting knob ④ until air bubble is located at middle position of spirit-level bubble ⑱. Loosen rotation adjustment knob ① to turn the instrument to the required direction.

***Notice**

Fastening screw ㊴ (placed inaccessories box) can be usedto better fasten vision testerwhen it is not matching withthe vision tester holding arm.

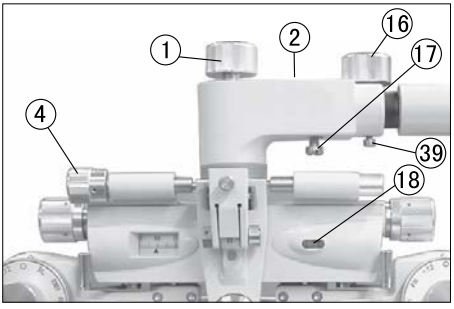


Fig.7

3.2 Attaching Near Point Rod, Near Point Card and Card Holde

First insert card holder ㉝ into near point rod ㉛, and slide it to a proper position. Then attach near point card ㉜ to an open aperture of card holder ㉝ (Fig.8). Afterwards, attach near point rod ㉛ onto near point rod holder ⑤, and fix clamping screw ③. When near point rod ㉛ is not used, raise it upwards (Fig.9).

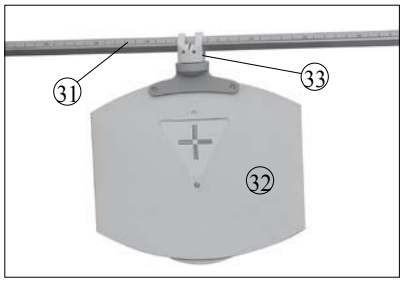


Fig.8

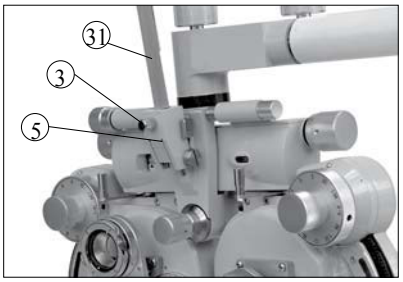


Fig.9

3.3 Attaching face shield

Attach face shield ㊱ so that face shield clip ⑮ catches it. Then align face shield aperture with examination aperture ⑬ (Fig.10).

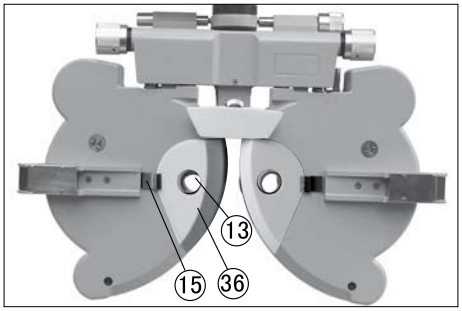


Fig.10

4.Operation Procedures

4.1 Spherical Lens

To show the spherical power only (shortened as "S"), turn auxiliary lens knob ㉑ to O position, then turn cylindrical lens knob ㉗ until "00" is shown on cylindrical power scale ㉕ . Then turn weak spherical power dial ㉓, value S is displayed in spherical power scale ㉔, within range from -19.00D~+16.75D, increasing or decreasing progressively in 0.25D (Fig.11).

To obtain required diopter setting quickly, use strong spherical power knob ㉒, then value S increases or decreases progressively in 3.00D diopter steps (Fig.12).

Note: Although several figures will appear on the scale, only three or four digit numbers have meaning. For example, if '075' is shown, it should be read as '0.75D', and if '1150' is shown, it should be read as '11.50D'.

Fig.11

Fig.12

4.2 Cylinder Lens

By turning cylindrical lens knob ㉗, the cylindrical power is shown on cylindrical power scale ㉕, with range from 0.00D to 6.00D, and increases or decreases progressively in 0.25D steps (Fig.13). By turning cylinder lens axis knob ㉖, the axis angle of

cylinder lens is shown on cylinder lens axis scale ㉘, with range of 0~180°; step: 5° (Fig.14)

Fig.13

Fig.14

4.3 Auxiliary Lens

Turn auxiliary lens knob ㉑, the required symbol is to be set at 12 o'clock position. Then Corresponding referenced lens will appear in the examination aperture ⑬ (Fig.15 and Fig.16).

Fig.15

Fig.16

The meaning of each mark.

O Open aperture

OC Shelter from aperture

±.50 Cross cylinder lens, with horizontal plus +axis. Used for presbyopia test

6 Δ U 6 diopter base up prism, used for horizontal phoria test

PH	A 1mm diameter pinhole is provided, used to determine reason of poor vision (due to refractive abnormity or their reasons)
+.12	+0.12D spherical lens, and spherical power can be set by 0.12D
⊕	Cross piece
RL	Red color-filter lens
RMH	Red Maddox rod lens, set horizontally
RMV	Red Maddox rod lens, set vertically
P	Polaroid filter, used for polarizing testing of stereoscopic vision
	Andbinocular balance of stereoscopic vision
R	Retinoscopic lens; +1.50D spherical lens (67cm)
10 Δ I	10 diopter base in prism, used for vertical phoria test
GL	Green color-filter lens
WMH	White Maddox rod lens, set horizontally
WMV	White Maddox rod lens, set vertically

Fig.17

To change direction of cross cylinder lens and polaroid filter, first remove the retaining ring and rear cover glass using screwdriver. Rotate the auxiliary lens knob ㉑ until auxiliary lens

is properly indexed and in alignment with examination aperture ⑬ . By slightly turning the auxiliary lens knob ㉑ in both directions, a screw and washer can be seen above and below the lens. Removing these two screws, auxiliary lens can be then removed. By reversing above procedure, reposition of lens is possible to ensure it is placed in a proper position (Fig.17).

4.4 Cross Cylindrical Lens

It is used for precise determination of cylinder power and axis. Turn cross cylindrical lens to the front of examination aperture. The letter"P" at its front sustenance face stands for the power, and hand-wheel direction stands for axis. When red dot aligns with "P" it indicates minus -0.25D cylindrical lens. When white dot aligns with "P"it indicates plus +0.25D cylindrical lens.

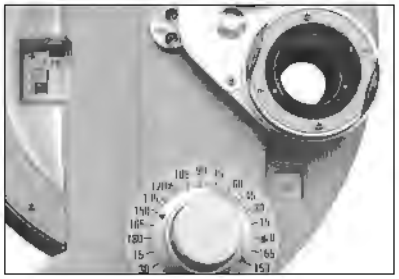


Fig.18

Fig.19

Fig.20

4.5 Rotary Prism

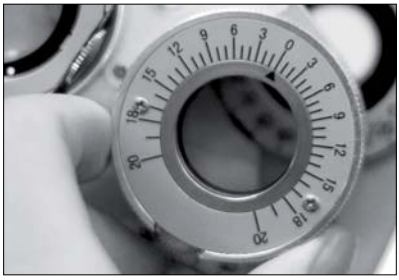


Fig.21

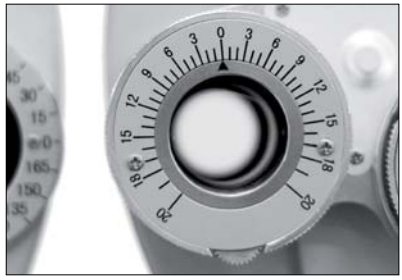


Fig.22

Turn rotary prism ⑫ by holding its base to set it on the examination aperture. Turn prism rotation knob ⑪ until the required prism power is set. What the black triangle arrow indicates is the current prism power. For example, prism power indicated in Fig.22 is 0, that in Fig.23 means base in 3 Δ prism power, and that in Fig.24 means base up 3 Δ prism power.

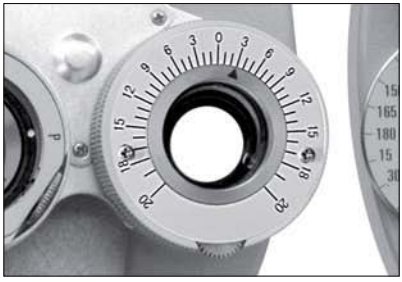


Fig.23

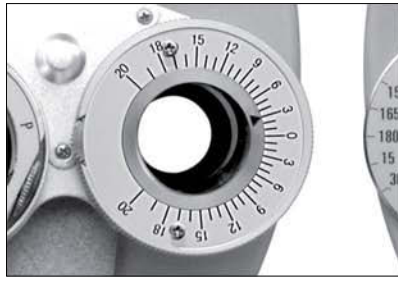


Fig.24

4.6 Corneal Aligning Device

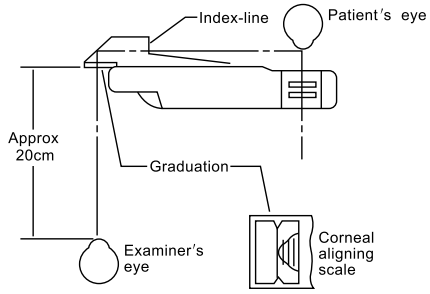


Fig.25

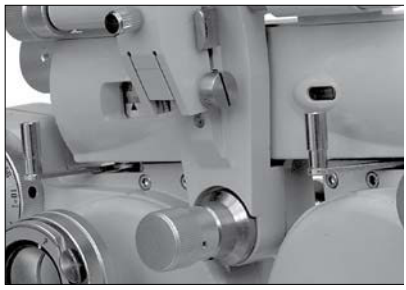


Fig.26

Turn forehead rest knob ⑨ to adjust position of forehead rest ㉙. After setting patient's forehead closely on forehead rest ㉙, look through the corneal aligning aperture ⑩ from around 20cm away. Look at the apex of the patient's cornea (Fig.25) after the examination aperture's pointer acme of corneal aligning aperture ⑩ aligns with the longer line on the scale. The longer line in the aperture means the measuring distance is 13.75mm, which is the standard spectacle wearing distance. Three shorter lines are provided by 2mm equal distance away from the longer line. If apex of the cornea of testee is positioned on second shorter line from the longer line, the lens power should be the value measured when spectacle is placed at 17.75mm away from apex of the cornea (standard value 13.75mm + correction value of second shorter line 4mm =17.75mm). If the actual spectacle wearing distance is different from the standard value (13.75mm), correction should be made according to Table 1 and Table 2.

Example 1 Assume that data of S +8.00D is obtained when the apex of the cornea positioned at the second shortest line from the longest line, meaning that it is 4mm away from the standard wearing distance. When referring to the correction factor in Table 1, it is known that the applied correction factor is +0.26D for

+8.00D diopter and 4mm distance. Therefore, the actual diopter of a patient who wears 13.75 distance standard spectacle is (+8.00D) + (+0.26D)=8.26D. The correction value changes by 0.25 D or 0.12D.

Example 2 Assume that the apex of cornea is between the second and third shortest lines from the longest line (5mm from the standard line), the obtained data is S-11.50D. It is known when referring the correction factor in Table 2 that for -11.50D and 5mm distance, the correction value should be (0.57+0.68)/2= 0.62D. Thus the actual diopter of a patient who wears 13.75 distance standard spectacle is (-11.50) + (+0.62)= -10.88D.

Example 3 When the cornea apex is on the third shortest line from the longest one, the obtained value is -14.00D: It is known when referring to correction factor in table 2 that for -14.00D and 6mm distance, the correction value should be 1.08D. So the actual diopter of a patient who wears 13.75 distance standard spectacle is (-14.00)+(1.08)= -12.92D.

If more accurate measurement is required, please calculate it according to following formula.

$$D'=D+\frac{LD^2}{1000-LD}$$

D: Measured power

D': Corrected power

L: Difference between measured distance and wearing distance(mm)

Correction Table 1 (When Correction Value of Measured Power is in Plus (+) Region)

D \ L	1	2	3	4	5	6	7	8	9	10
+1.00	.001	.002	.003	.004	.005	.006	.007	.008	.009	.01
+2.00	.004	.008	.01	.02	.02	.02	.03	.03	.04	.04
+3.00	.009	.02	.03	.04	.05	.06	.06	.07	.08	.09
+4.00	.02	.03	.05	.07	.08	.10	.12	.13	.15	.17
+5.00	.03	.05	.08	.10	.13	.15	.18	.21	.24	.26
+6.00	.04	.07	.11	.15	.19	.22	.26	.30	.34	.38
+7.00	.05	.10	.15	.20	.25	.31	.36	.42	.47	.53
+8.00	.06	.13	.20	.26	.33	.40	.47	.55	.62	.70
+9.00	.08	.16	.25	.34	.42	.51	.61	.70	.79	.89
+10.00	.10	.20	.31	.42	.53	.64	.75	.87	.99	1.11
+11.00	.12	.25	.38	.51	.64	.78	.92	1.06	1.21	1.36
+12.00	.15	.30	.45	.61	.77	.931	.10	1.27	1.45	1.64
+13.00	.17	.35	.53	.71	.90	1.10	1.30	1.51	1.72	1.94
+14.00	.20	.40	.61	.83	1.05	1.28	1.52	1.77	2.02	2.28
+15.00	.23	.46	.71	.96	1.22	1.48	1.76	2.05	2.34	2.65
+16.00	.26	.53	.83	1.09	1.39	1.70	2.02	2.35	2.69	3.05
+17.00	.29	.60	.91	1.24	1.58	1.93	2.30	2.68	3.07	3.48
+18.00	.33	.67	1.03	1.40	1.78	2.18	2.59	3.03	3.48	3.95
+19.00	.37	.75	1.15	1.56	1.99	2.44	2.91	3.41	3.92	4.46
+20.00	.41	.83	1.28	1.74	2.22	2.73	3.26	3.81	4.39	5.00

Correction Table 1(When Correction Value of Measured Power is in Minus (-) Region)

D \ L	1	2	3	4	5	6	7	8	9	10
-1.00	.001	.002	.003	.004	.005	.006	.007	.008	.009	.01
-2.00	.004	.008	.01	.02	.02	.02	.03	.03	.04	.04
-3.00	.009	.02	.03	.04	.04	.05	.06	.07	.08	.09
-4.00	.02	.03	.05	.06	.08	.09	.11	.12	.14	.15
-5.00	.02	.05	.07	.10	.12	.15	.17	.19	.22	.24
-6.00	.04	.07	.11	.14	.17	.21	.24	.27	.31	.34
-7.00	.05	.10	.14	.19	.24	.28	.33	.37	.41	.46
-8.00	.06	.13	.19	.25	.31	.37	.42	.48	.54	.59
-9.00	.08	.16	.24	.31	.39	.46	.53	.60	.67	.74
-10.00	.10	.20	.29	.38	.48	.57	.65	.74	.83	.91
-11.00	.12	.24	.35	.46	.57	.68	.79	.89	.99	1.09
-12.00	.14	.28	.42	.55	.68	.81	.93	1.05	1.17	1.29
-13.00	.17	.33	.49	.64	.79	.94	1.08	1.22	1.36	1.50
-14.00	.19	.38	.56	.74	.92	1.08	1.25	1.41	1.57	1.72
-15.00	.22	.44	.65	.85	1.05	1.24	1.43	1.61	1.78	1.96
-16.00	.25	.50	.73	.96	1.19	1.40	1.61	1.82	2.01	2.21
-17.00	.28	.56	.82	1.08	1.33	1.57	1.81	2.04	2.26	2.47
-18.00	.32	.63	.92	1.21	1.49	1.75	2.01	2.27	2.51	2.75
-19.00	.35	.70	1.02	1.34	1.65	1.94	2.23	2.51	2.77	3.03
-20.00	.39	.77	1.13	1.48	1.82	2.14	2.46	2.76	3.05	3.33

4.7 Near Point Card

If the lens is multifocal, it is required to measure lens diopter at near distance. Then near point rod ㉛, card holder ㉝ and near point card ㉜ can be used. Lower near point rod ㉛ , keeping rod horizontal is the correct setting for measurement (Fig.27)

Near point distance from 15cm to 70cm (i.e. about 6 inches to 28 inches), and lens diopter from +8D to +1.5D are provided. The value indicated at tail of card holder ㉝ is just the value to the card from apex of the cornea (Fig.28). Select the required sight mark on the near point card. Turn the rotating portion along the card center by the finger until the required value appears in the sight window.

Fig.27

Fig.28

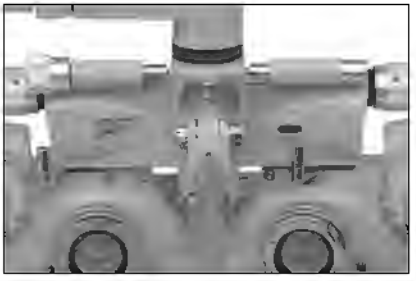


Fig.29

Then turn vergence lever ⑧ inward to move the instrument so that main axis of lens faces to 380mm. Now near point testing can be carried out (Fig.29).

4.8 Examination Procedures

Following is an example of examination. Before examination, patient's visual acuity should be determined.

Example: Testee, 35 years old, who wears spectacles.

First, use lensmeter to measure the spectacles he is wearing, with following results:

PD 63mm

R -1.00DS/-0.50DC 90°

L -1.25DS/-0.50DC 180°

Examining results show pupil distance of Testee is 63mm; spherical power of his right eye is -1.00D, with astigmatic power of -0.50D, and axis 90°; spherical power of his left eye is -1.25D, with astigmatic power of -0.50D, and axis 180°.

With these spectacles worn in examination, visual acuity of Testee's left and right eyes is all 0.7(20/30). Then use a comprehensive optometry meter to precisely measure diopter power of Testee's left and right eyes at present.

4.8.1 Installing Instrument

(1)Attach the near point rod ㉛ downwards to near point rod holder ⑤ (Fig.9).

(2)Set the spherical lens power (value S) and cylinder lens power (value C) to zero.

(3)Before examination, first set pupil distance. Turn pupil distance knob ⑥, so that pupil distance of Testee is shown in pupil distance scale ⑦.

(4) Move the instrument so that the instrument's side shown in Fig.4 is facing to Testee. Now place forehead of Testee on the forehead rest ㉙.

(5)Turn leveling adjusting knob ④ while observing air bubble until the air bubble moves to middle of the water bubble.

(6) Determine the distance between vertex of cornea and the instrument.

(7) To measure right eye first, turn auxiliary lens knob to set O for right eye, and OC for left eye.

4.8.2 Examination Using "Fogging Method"

(1)Add 3.00D to the estimated S value for right eye. Then power of his spectacle is -1.00D, namely, (-1.00)+(+3.00)= +2.00D.

(2)In this condition, Testee is unable to clearly see the projected chart. Gradually add minus power. In example of Testee , reduce S value gradually by turning weak spherical power dial ㉓ : 2.00→1.75→1.5→0.5 until it shows -1.00 D.

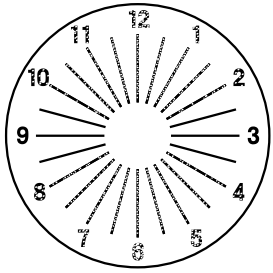


Fig.30

Fig.31

(3)Project the astigmatic chart while asking Testee if he can see it. If Testee says he can see it as shown in Fig.30, turn the cylindrical lens axis knob ㉖ to 90° from the darkest line he has seen (see Fig.31). If Testee says all lines are equally bright, it

means no astigmatism is existent. Then procedures (3) and (4) in 4.8.2 and procedure 4.8.2 are not required.

(4) Turn cylindrical lens knob ㉗ to change C value, .00→.25→.50 so every line is seen equally. When it is turned to -0.50, the chart is as shown as Fig.32.

(5) Change S by 0.25D steps by turning weak spherical power dial ㉓ so that the visual acuity becomes from 1.2 to 1.5. Record the changed value of the visual acuity.

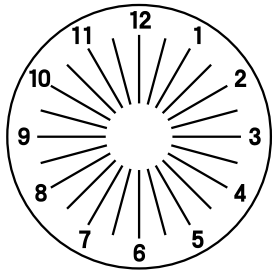


Fig.32

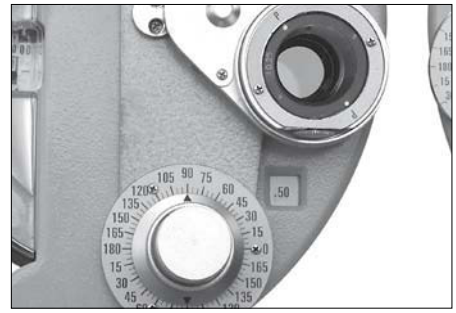


Fig.33

For myopia, spectacles with least power should be selected, and for presbyopia, spectacles with largest power should be selected. To correct Testee's vision to that of 1.5, his spectacle power may be -1.75, -2.00 or -2.25, and then -1.75 should be selected. Now examination is almost completed, however, more precise measurement is required.

4.8.3 Precise Refining Cylinder Axis and Power

(1) Set cross cylindrical lens ⑳ in front of Testee 's right eye and, turning rotation knob ⑲ axially, to align it with axial direction of cylindrical lens (see Fig.33).

(2) Project the cross cylinder dot chart as shown in Fig.34. Turn rotation knob ⑲ with finger to rotate cross cylindrical lens ⑳. Then ask Testee to compare the two images he sees before

and after turning the cross cylindrical lens. Stop at the better side. For example, if what Testee sees is clearest as shown in Fig.35 of cross cylindrical lens, turn cylindrical lens axis knob ㉖ to move axis of cross cylindrical lens by 5° in direction of red dot, so that position of cylindrical lens axis scale ㉘ is positioned at 95°.

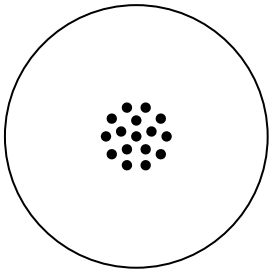


Fig.34

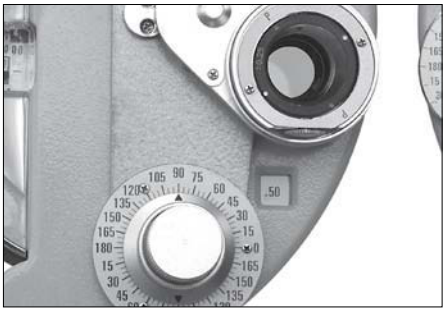


Fig.35

(3) Turn the lens again to make a comparison. If what Testee sees is the most clearest as shown in Fig.37, move cross cylindrical lens axially towards red dot by 5°, enabling it to become 100°.

(4)Turn the lens again. If Testee cannot report any difference, precise examining cylinder axis is completed (with astigmatic axis of 100°).

(5) Now to conduct precise measurement of cylinder power (C), and turn letter P to original axis (see Fig.37).

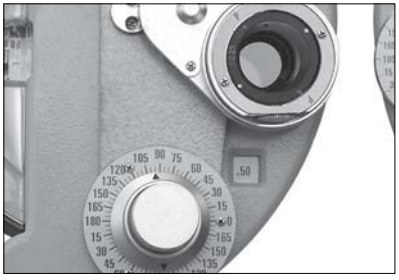


Fig.36

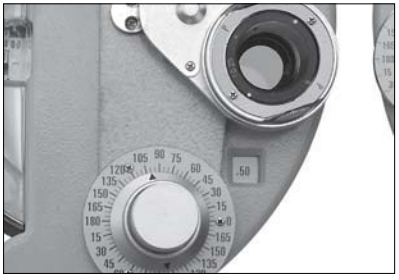


Fig.37

(6) Use cross cylinder dot chart shown in Fig.34 with same procedure as described in (2). Now ask Testee to compare the charts he sees. The result is shown as Fig.38. If Testee sees the clearest chart when red dot matches with letter P (as shown in Fig.38), it means Testee's diopter has increased by 0.25D (now Testee's diopter power is 0.75D).

(7) Turn the lens again to make a comparison. If the chart as shown in Fig.39 is the clearest, the diopter power should be decreased by 0.25D because white dot is positioned at P. If the red dot is positioned at P, it means diopter power is increased by 0.25D, thus totally 0.5D is added.

Fig.38

Fig.39

(8) Turn the lens again to verify the finding. If Testee reports that the chart in the setting of Fig.39 is clearest, the correct modified power should be between 0.25D and 0.5D. Hence the accurate power should be -0.62D.

4.8.4 Precise Refining Spherical Power (Red-Green Test)

(1) Use red and green chart to determine precise spherical lens value (see Fig.40). Ask the patient which one is seen clearest, red or green chart. If the green one is seen better, it indicates myopia is increased (hyperopia decreased). The reduce spherical lens value by 0.25D. -1.75→-1.50.

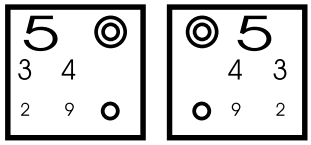


Fig.40

(2) Ask Testee again to affirm which chart is seen clearer, the clearer red stands for decreased myopia (increased hyperopia). Testee's power is 1.62D. Generally, the weak spherical power dial is used to adjust myopia (and strong spherical power dial is used to adjust hyperopia).

(3) Now right eye examination is completed, with lens power result as follows:

Spherical power 1.50 Cylinder power 0.50 and Axis 100°

R -1.50DS/-0.50DC 100°

Then examine the left eye. Turn auxiliary lens knob ㉑ , to set O for left eye, and OC for right eye. Then use same measuring method to measure left eye.

Testee 's left eye is measured as:

L -2.00DS/-0.50DC 170°

4.8.5 Binocular Balance Test

(1) Rotary Prism Method

a. Tests are performed for left and right eyes independently, in which, binocular prism shall be used for both eyes. On the whole, these tests are referred to as the binocular balance test. Set both eyes to O. Use the chart shown in Fig.34 and set prisms as 2 Δ BU (right eye), and 2 Δ BD (left eye) (see Fig.41).

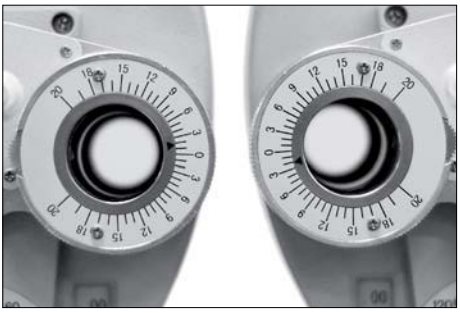


Fig.41

b. Now Testee sees two images of chart, one at upper side and one at lower side. When asked which image is seen clearest, Testee replies the upper one is clearest. Then add +0.25D to spherical lens value of right eye. When the image at lower side is seen clearest, add +0.25D to spherical lens value of left eye, namely, (-2.00)+(+0.25)= -1.75D.

c. Ask Testee again to affirm which one is clearest. When both become similar, it means balance test is completed.

d. Remove the rotary prism. Add spherical lens power of + 1.00D to both eyes. So, Testee's visual acuity should be:

R -0.50DS /-0.50DC A l00°

L -0.75DS /-0.50DC A l70°

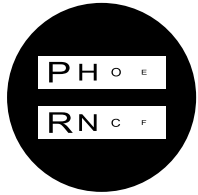
e. Now add minimum power of 0.25D to binocular spherical lens value . Gradually change the spherical lens value until he can see 1.2 or 1.5(20/15) visual mark clearly . He desires to see 1.5(20/15) clearly, then change spherical lens value as follows:

R -1.50DS /-0.50DC A l00°

L -1.75DS /-0.50DC A l70°

(2) Polarizing filter method

a. Turn auxiliary lens knob ㉑ to P (both eyes). Project the polarized binocular balance test chart.



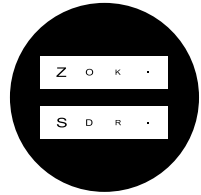


Fig.42 Fig.43

b. Now Testee sees two images, one at upper side and one at lower side. When asked which image is seen clearest, Testee replies the upper one is clearer, and he can see upper row of the chart by his right eye, and the lower row by his left eye. If both rows can be seen with equal clarity, it means the balance is good. When both rows are not seen with equal clarity, add +0.25D spherical lens value to one eye with better clarity until both columns are seen with equal clarity.

c. Turn auxiliary lens knob ㉑ to O (both eyes). Add +1.00D to spherical lens value of both eyes.

d. Gradually reduce spherical lens value by precision of minimum 0.25D until visual acuity for both eyes becomes 1.2 or 1.5.

4.8.6 Measuring Phoria at Far Point

(1) Maddox rod and rotary prism method

a. First conduct horizontal phoria measurement. Proceed according to (1) rotary prism method described in 4.8.5 Binocular Balance Test. Turn auxiliary lens rotation knob ㉑, and set right eye to RMH (Fig.44). Turn prism rotation knob ⑪ with its setting 0 on the triangle symbol facing the left eye. Light a small fixation light at the position where the chart is projected. Now Testee's right eye can see a red vertical line (see Fig.45 a), and his left eye can see a light spot (see Fig.45 b). They are probably (a) or (b) of Fig.46. The light spot will also move when prism rotation knob ⑪ is turned. Then ask the patient to tell when he sees the image

shown in Fig.46 b. The test result is shown in Fig.47. The prism rotation scale is shown as 2. The result of 2ΔBI (base inward) stands for 2 Δ inclination outward.

b. Then measure vertical phoria. As shown in Fig.48, turn auxiliary lens knob ㉑ and set RMV for the right eye. Turn rotation prism lens ⑫ to set the left eye at horizontal position. Now Testee can see red horizontal line with the right eye, and the light spot with the left eye. Then using same procedure of a, ask Testee when he can see red line and light spot meet while turning prism lens rotation knob ⑪. When it is shown as Fig.49, Testee reports they meet, it is 0.5, below 0, indicating left eye is 0.5ΔBD, called 0.5Δ upward heterophoria.

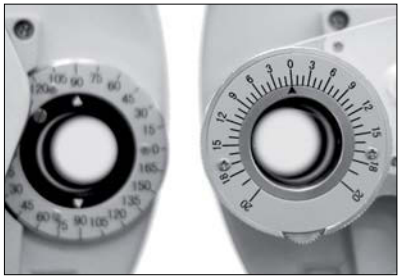


Fig.44

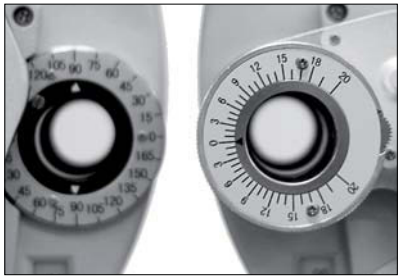


Fig.48

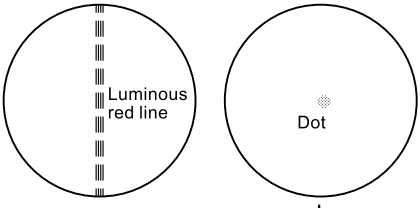


Fig.45

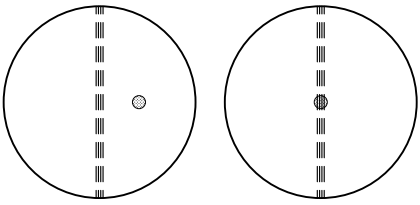


Fig.46

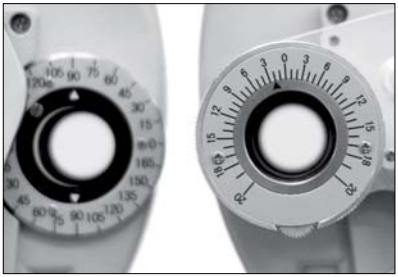


Fig.47

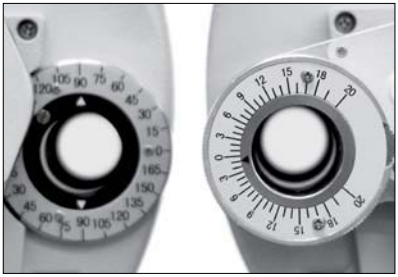


Fig.49

(2) Polarizing Filter Method

a. Turn auxiliary lens knob ㉑ to P and project the polarizing chart (Fig.50).

b. Unless the patient has phoria, four lines seen to the patient will be shown as Fig.50. If the patient has phoria, these four lines will not be in alignment.

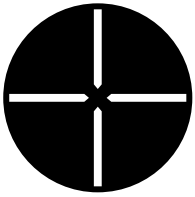


Fig.50

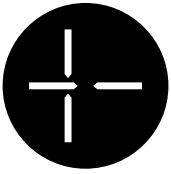


Fig.51-a

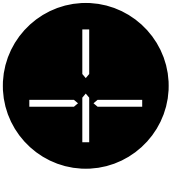


Fig.51-b

c. When the vertical lines are seen disposed as shown in Fig.51-a, turn rotation prism ⑫ of the left eye with 0 scale upward. Then turn prism rotation knob ⑪ slowly so that the image is shown as Fig.50 (horizontal phoria).

d. When horizontal lines are seen disposed as shown in Fig.51-b, adjust 0 scale to horizontal position, and then turn prism rotation knob 11 so that the image is as shown in Fig.50 (vertical phoria).

e. When both vertical and horizontal lines are disposed to have phoria, as shown in Fig.51-c, adjust rotary prism ⑫ to make scale 0 vertical so that the vertical line is in the middle of horizontal line, as shown in Fig.51-b (horizontal phoria). Afterwards, adjust scale 0 to be horizontal. Turn prism rotation knob ⑪ so that horizontal lines are in the middle of vertical line, as shown in Fig.51-a (vertical phoria).

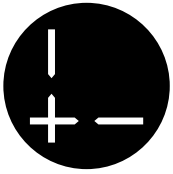


Fig.51-c

4.8.7 Arranging Results

Now, examination of Testee is completed. If the results show Testee has severe phoria, the spectacles should be adjusted. If not, the prescription would be:

PD 63mm

R -1.5DS/-0.5DC 100°

L -1.75DS/-0.5DC 170°

4.8.8 Presbyopia Test

This test is provided to those who are more than 45 years old.

a. First, affirm distance of measurement and put it in the examination aperture. Attach near point rod ㉛ and near point rod holder ⑤ to the instrument, then fix them firmly using clamping screw ③ .

b. Turn auxiliary lens knob ㉑ to ±.50D (both eyes).

c. Use near point card ㉜ as near point examination of the patient. Ask the patient how about the vertical line and horizontal line he sees. If presbyopia is seen, the horizontal line will be seen clearly, with vertical line being dull (if both lines are seen equally, presbyopia spectacles are unnecessary).

d. Add 0.25 to both eyes' S simultaneously until horizontal line and vertical line are equally discernible.

e. Change ±.50 of both eyes to O. Turn the near distance card to show small letters. Then ask the patient if letters are clear. A proper adjustment is required for S value. The measurement is complete. Record the results.

4.8.9 Phoria at Near Distance

(1) Horizontal Phoria

If the patient has no presbyopia, set the results of phoria tested at far point in aperture. If the patient has presbyopia, put the results on the near point test. Set the near point card at 40cm, and turn auxiliary lens knob ㉑ to set the right eye at 6 Δ U so that letter rows are fully separated. If the patient has horizontal phoria, it will be shown as Fig.52. Turn rotary prism ⑫ to the other eye, with 0 scale upward.(see Fig.54) Turn prism rotation knob ⑪ so that there is no difference between the left and right eyes and, at this time, scale of the rotary prism indicates prism power(see fig.53).

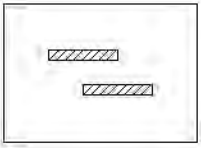


Fig.52

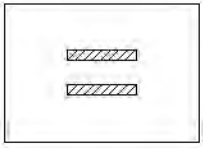


Fig.53

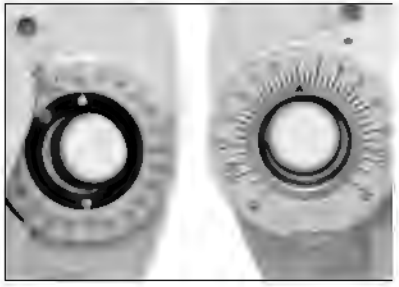


Fig.54

(2) Vertical Phoria

Turn auxiliary lens knob ㉑ to set the left eye at 10 Δ I so that letter columns are completely separated. If the patient has vertical phoria, it will be shown as Fig.55. Then turn the rotary prism to the other eye, with scale of 0 horizontal (as shown in Fig.57). Turn prism rotation knob ⑪ so that there is no difference between the upper and the lower (see Fig.56). Then scale of rotary prism indicates vertical phoria power.

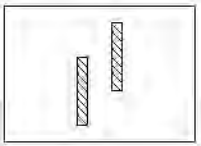


Fig.55

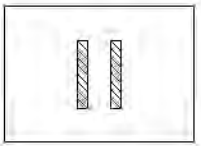


Fig.56

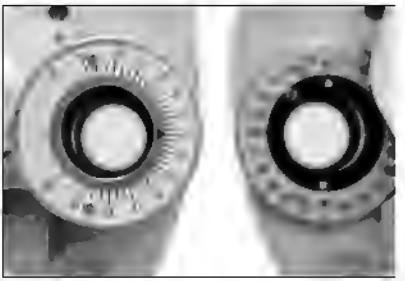


Fig.57

4.8.10 Other Measurements

(1) Vergence (eyeball movement in different direction)

Set rotary prism ⑫ in front of both eyes, and place 0 setting in uppermost position. To measure adduction of eyeball at far point, turn the prism outward for both eyes simultaneously. When the chart is seen as two images in the vertical direction (the point where double vision first occurs), the reading at this time indicates adduction power. The rotary prism can be used to measure maximum 40 Δ only (about 22°). For abduction measurement, turn the prism of both eyes inwards simultaneously. When the object is seen as a double image, record the readings. Maximum range of measurement is 40 Δ . If 10 Δ BI is used on auxiliary lens disk, maximum test value is 50 Δ . Adduction and abduction at near point can be measured when the near point card is fixed to near point rod ㉛ . The method for other measurements is identical.

(2) Vertical Abduction

Set rotary prism ⑫ in front of both eyes, and place 0 setting in horizontal position. Use the horizontal letters in the visual acuity chart for far point (5m) test, and use near point card to conduct near point test. Turn prism rotation knob ⑪ and, when horizontal letters are seen as a double image, record the reading, which is patient's vertical abduction power.

4.8.11 Transposition of Prescriptions

In Comprehensive Optometry Device, myopia astigmatic method is used to carry out fogging measurement. However, when hyperopia astigmatism is required sometimes, please use correction results in following formula.

XDS/YDC AZ°→(X+Y)DS/(-Y)DC (Z±90) °

S: Add the cylinder lens power to the spherical lens power

C: Convert the index (+-) of cylinder lens power

A: Add 90° when Z is less than 90°; and deduct 90° when Z is larger than 90°.

Example 1:

For +4.00DS/-1.50DC ×155°, changed to

S:(+4.00)+(-1.50)= +2.50

C:(-1.50)= +1.50

A:155°-90°= 65°

So the result is

+2.50DS/+1.50DC×65°

Example 2:

For +1.5DS/+0.75DC×75°

S:(+1.5)+(+0.75)= +2.25

C:-(+0.75)= -0.75

A:75°+90°= 165°

So the result is:

+2.25DS/-0.75DC×165°

5.Maintenance

5.1 Daily Care

(1) Use dust cover ㉞ to protect the instrument from dust when it is not in use.

(2) For long-term storage, keep the instrument in a dry place free of dust.

(3) When lens becomes dirty, use lens cleaning cloth moistened with a little absolute alcohol to wipe it.

(4)Before operation. Clean Forehead Rest ㉙ and nosepiece with medical cotton watted with absolute alcohol.

5.2 Checking and Servicing Procedure

In normal use, no special checking or servicing is necessary. However, when it is used at extremely low temperature, the turning knobs or dials will become heavier than usual because of lubricant used inside, instead of any mechanical reason. When temperatures return to normal, all will be normal.

6 Before Requesting Service-Troubleshooting Guide

If any problem occurs, first check the following items, and follow the suggested instructions . When the trouble cannot be eliminated, please contact us.

(1) The required lens cannot be set at examination aperture

·Is knob turned to correct position?

·Is any other lens attached to the patient's examination aperture?

(2) When vergence lever 8 is adjusted, does any action of corresponding vergence occur?

7 Optional Accessories - Cylinder Lens

Three types of spare lens are optional: -2.00CYL,-0.12CYL and 00CYL.

R-2600 MANUAL REFRACTOR

9990 NW 14 Street | Suite 105 | Doral, FL 33172
Telephone: 888.334.4640